

1     What is claimed is:

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3     1. An air conditioning system, comprising:

4  
5     a compressor for compressing a refrigerant, the refrigerant being a compressible phase change fluid;

6  
7     a condensing unit operatively connected to the compressor;

8  
9     an evaporator unit and an associated expansion means operatively interconnected to the condensing  
10    unit and to the compressor, the evaporator unit being in heat exchange relationship with a supply air  
11    stream for an indoor space inside a structure, the compressor being operable to circulate the  
12    refrigerant between the condensing unit and the evaporator unit to cool the supply air stream;

13  
14    a thermal energy storage unit including a tank having a thermal energy storage medium disposed  
15    therein and having an associated heat exchanger, the heat exchanger being operably connected to the  
16    compressor and evaporator;

17  
18    a refrigerant circulating device for circulating refrigerant through the heat exchanger in the tank and  
19    between the tank and the condenser and evaporator;

20  
21    wherein the refrigerant circulating device includes a prime mover and an auxiliary liquid which is  
22    acted upon by the prime mover, the auxiliary liquid being coupled to the refrigerant, whereby force  
23    exerted by the prime mover on the auxiliary liquid is indirectly transferred to the refrigerant.

24  
25    2. The air conditioning system of claim 1, wherein the auxiliary liquid has a higher relative viscosity  
26    and a lower relative vapor pressure than the refrigerant.

27  
28    3. The air conditioning system of claim 1, wherein the refrigerant is Freon.

29  
30    4. The air conditioning system of claim 1, prime mover is a positive displacement pump.

1 5. The air conditioning system of claim 1, wherein the prime mover communicates with a pair of fluid  
2 cylinders containing oil as an auxiliary fluid and wherein the prime mover exerts a motive power upon  
3 pistons located within the fluid cylinders to thereby mechanically couple the motive power of the  
4 prime mover to the refrigerant being circulated in the system.

5  
6 6. The air conditioning system of claim 1, wherein the prime mover communicates with a pair of fluid  
7 cylinders containing the auxiliary fluid and wherein the prime mover exerts a motive power on a  
8 flexible bladder located within the each of the fluid cylinders to thereby couple the motive power of  
9 the prime mover to the refrigerant being circulated in the system.

10  
11 7. The air conditioning system of claim 1, wherein the prime mover is powered by a direct current  
12 motor and battery.

13  
14 8. The air conditioning system of claim 1, wherein the storage medium in the tank is water.

15  
16 9. An air conditioning system, comprising:

17  
18 a compressor for compressing a refrigerant, the refrigerant being a compressible phase change fluid;

19  
20 a condensing unit operatively connected to the compressor;

21  
22 an evaporator unit and an associated expansion means operatively interconnected to the condensing  
23 unit and to the compressor, the evaporator unit being in heat exchange relationship with a supply air  
24 stream for an indoor space inside a structure, the compressor being operable to circulate the  
25 refrigerant between the condensing unit and the evaporator unit to cool the supply air stream;

26  
27 a thermal energy storage unit including a tank having a thermal energy storage medium disposed  
28 therein and having an associated heat exchanger, the heat exchanger being operably connected to the  
29 compressor and evaporator, the thermal energy storage unit further including a temporary refrigerant  
30 storage tank;

1 a refrigerant circulating device for circulating refrigerant through the heat exchanger in the tank and  
2 between the tank and the condenser and evaporator;

3  
4 wherein the refrigerant circulating device includes a prime mover and an auxiliary liquid which is  
5 acted upon by the prime mover, the auxiliary liquid being coupled to the refrigerant, whereby force  
6 exerted by the prime mover on the auxiliary liquid is indirectly transferred to the refrigerant;

7  
8 a valve system for controlling the flow of refrigerant through the air conditioning system, the valve  
9 system being operative to provide three distinct time periods of operation for the system, a first time  
10 period which allows refrigerant to flow from the condenser to the heat exchanger of the thermal  
11 energy storage unit to freeze the medium in the tank and to then return to the condenser without  
12 utilizing the evaporator, a second time period which bypasses the condenser and circulates refrigerant  
13 through the thermal storage unit and through the evaporator to thereby cool the supply air inside the  
14 structure before returning to the thermal storage unit, and a third time period which utilizes only the  
15 temporary refrigerant storage vessel of the thermal storage unit and which utilizes the condenser and  
16 evaporator to cool the supply air inside the structure as if the thermal storage unit were not present.

17  
18 10. The air conditioning system of claim 9, wherein the auxiliary liquid has a higher relative viscosity  
19 and a lower relative vapor pressure than the refrigerant.

20  
21 11. The air conditioning system of claim 9, wherein the prime mover is a positive displacement pump.

22  
23 12. The air conditioning system of claim 9, wherein the prime mover communicates with a pair of  
24 fluid cylinders containing oil as an auxiliary fluid and wherein the prime mover exerts a motive power  
25 upon pistons located within the fluid cylinders to thereby mechanically couple the motive power of  
26 the prime mover to the refrigerant being circulated in the system.

27  
28 13. The air conditioning system of claim 9, wherein the prime mover communicates with a pair of  
29 fluid cylinders containing the auxiliary fluid and wherein the prime mover exerts a motive power on  
30 a flexible bladder located within the each of the fluid cylinders to thereby couple the motive power  
31 of the prime mover to the refrigerant being circulated in the system.

1 14. The air conditioning system of claim 9, wherein the prime mover is powered by a direct current  
2 motor and battery.

3  
4 15. The air conditioning system of claim 9, wherein the storage medium in the tank is water.

5  
6 16. A method of operating an air conditioning system having a compressor, a condensing unit, an  
7 expansion unit and an evaporator, all operative interconnected, the evaporator unit being in heat  
8 exchange relationship with a supply air stream for an indoor space inside a structure, the compressor  
9 being located exterior to the structure and being operable to circulate refrigerant between the  
10 condensing unit and the evaporator unit to cool the supply air stream, the method comprising the  
11 steps of:

12  
13 locating a thermal energy storage unit exterior to the structure to be cooled and connecting the  
14 thermal storage unit solely to refrigerant lines running to and from the compressor without altering  
15 the existing expansion unit and evaporator unit;

16  
17 operating the air conditioning system through at least two distinct phases of operation, one phase of  
18 operation including the running of the compressor to supply refrigerant to the expansion unit and the  
19 evaporator unit to cool the indoor space inside the structure and another distinct phase of operation  
20 being the operation of the thermal energy storage unit to exactly simulate the running of the  
21 compressor without powering the compressor.

22  
23 17. The method of claim 16, wherein the thermal storage unit includes a tank, a storage medium  
24 within the tank, and a heat exchanger located in the tank.

25  
26 18. The method of claim 17, wherein the system is further provided with a refrigerant circulating  
27 device for circulating refrigerant through the heat exchanger in the tank and between the tank and the  
28 condenser and evaporator unit; wherein the refrigerant circulating device includes a prime mover and  
29 an auxiliary liquid which is acted upon by the prime mover, the auxiliary liquid being coupled to the  
30 refrigerant, whereby force exerted by the prime mover on the auxiliary liquid is indirectly transferred  
31 to the refrigerant.

1 19. The method of claim 18, wherein the auxiliary liquid has a higher relative viscosity and a lower  
2 relative vapor pressure than the refrigerant.

3  
4 20. The method of claim 18, wherein the prime mover is a positive displacement pump.

5  
6 21. The method of claim 18, wherein the prime mover communicates with a pair of fluid cylinders  
7 containing oil as an auxiliary fluid and wherein the prime mover exerts a motive power upon pistons  
8 located within the fluid cylinders to thereby mechanically couple the motive power of the prime mover  
9 to the refrigerant being circulated in the system.

10  
11 22. The method of claim 18, wherein the prime mover communicates with a pair of fluid cylinders  
12 containing the auxiliary fluid and wherein the prime mover exerts a motive power on a flexible bladder  
13 located within the each of the fluid cylinders to thereby couple the motive power of the prime mover  
14 to the refrigerant being circulated in the system.

15  
16 23. The method of claim 18, wherein the prime mover is powered by a direct current motor which  
17 is connected to a battery as an energy source.

18  
19 24. A method of operating an air conditioning system having a compressor, a condensing unit, an  
20 expansion unit and an evaporator, all operative interconnected, the evaporator unit being in heat  
21 exchange relationship with a supply air stream for an indoor space inside a structure, the compressor  
22 being located exterior to the structure and being operable to circulate refrigerant between the  
23 condensing unit and the evaporator unit to cool the supply air stream, the method comprising the  
24 steps of:

25  
26 locating a thermal energy storage unit exterior to the structure to be cooled and connecting the  
27 thermal storage unit solely to refrigerant lines running to and from the compressor without altering  
28 the existing expansion unit and evaporator unit;

29  
30 providing control means for controlling the flow of refrigerant through the air conditioning system,  
31 control means being operative to provide three distinct time periods of operation for the system, a

1 first time period which allows refrigerant to flow from the condenser to the heat exchanger of the  
2 thermal energy storage unit to freeze the medium in the tank and to then return to the condensing unit  
3 without utilizing the evaporating unit, a second time period which bypasses the condensing unit and  
4 circulates refrigerant through the thermal storage unit and through the evaporating unit to thereby  
5 cool the supply air inside the structure before returning to the thermal storage unit, and a third time  
6 period which utilizes only the temporary refrigerant storage vessel of the thermal storage unit and  
7 which utilizes the condensing unit and evaporating unit to cool the supply air inside the structure as  
8 if the thermal storage unit were not present.

9  
10 25. The method of claim 24, wherein a refrigerant circulating device is provided for circulating  
11 refrigerant through the heat exchanger in the tank and between the tank and the condensing unit and  
12 evaporating unit;

13  
14 wherein the refrigerant circulating device includes a prime mover and an auxiliary liquid which is  
15 acted upon by the prime mover, the auxiliary liquid being coupled to the refrigerant, whereby force  
16 exerted by the prime mover on the auxiliary liquid is indirectly transferred to the refrigerant.